

## CLAIMS

- 1 1. In a bone implant for a bony substance having an implant body with a  
2 surface that is compatible with bone cells having an average size and  
3 wherein the surface has a macrostructure that contacts the bony substance  
4 and a microstructure for anchoring the implant in the cell area, the  
5 improvement wherein the microstructure comprises an array of densely  
6 packed rounded domes separated by rounded lacunae, and wherein the  
7 size of the domes, their distances from one another and the depth of the  
8 lacunae are substantially the same order of magnitude as the average size  
9 of the bone cells.
- 1 2. The improvement of claim 1, wherein parts of the implant body surface are  
2 pretreated by sandblasting and acid etching and wherein the microstructure  
3 comprises a cover layer formed on the implant body surface parts.
- 1 3. The improvement of claim 2 wherein the cover layer is fabricated from a  
2 material in the group consisting of titanium and titanium alloys.
- 1 4. The improvement of claim 2 wherein the bone cells have a profile with a  
2 surface roughness and wherein the cover layer comprises a layer of  
3 sputtered material having a thickness which corresponds substantially to the  
4 surface roughness of the bone cell profile.
- 1 5. The improvement of one of claims 2-4 wherein the cover layer has a  
2 thickness between 0.1 and 2 micrometers.
- 1 6. The improvement of one of claims 2-4, wherein implant body surface parts  
2 which are pretreated by sandblasting and acid etching and on which is

3 formed the cover layer are delineated from other surface parts of the implant  
4 by masking.

1 7. The improvement of claim 1 further comprising a nanostructure  
2 superimposed on the microstructure, the nanostructure being comprised of  
3 a densely packed array of rounded domes separated by rounded lacunae,  
4 wherein the size of the nanostructure domes, the distances from one  
5 nanostructure dome to another and the depth of the nanostructure lacunae  
6 are smaller than the corresponding dimensions of the microstructure by  
7 approximately one decimal order of magnitude.

1 8. The improvement of claim 7, wherein the depth of the nanostructure lacunae  
2 is in the range of 10-500 nm wherein and the distance between  
3 nanostructure domes is in the range of 100-500 nm.

1 9. A method of producing a bone implant that is compatible with bone cells  
2 having an average size, the method comprising:  
3 (a) fabricating an implant body with a biocompatible surface,  
4 (b) pretreating parts of the implant body surface to roughen the implant  
5 body surface;  
6 (c) reshaping the roughened implant body surface by application and  
7 removal of material to create a microstructure comprised of an array  
8 of densely packed rounded domes separated by rounded lacunae;  
9 and  
10 (d) selecting parameters of steps (b) and (c) so that a size of the domes,  
11 distances from one dome to another and a depth of the lacunae are  
12 substantially the same order of magnitude as the average size of the  
13 bone cells.

- 1 10. The method of claim 9 wherein step (b) comprises sandblasting the implant  
2 body surface.
- 1 11. The method of claim 9 wherein step (b) comprises acid etching the implant  
2 body surface.
- 1 12. The method of claim 9 wherein step (b) comprises sandblasting the implant  
2 body surface and acid etching the sandblasted implant body surface.
- 1 13. The method of any one of claims 8-12, wherein step (c) comprises applying  
2 a cover layer to the roughened implant body surface.
- 1 14. The method of claim 13, wherein step (c) comprises applying the cover layer  
2 by sputtering.
- 1 15. The method of claim 13, wherein step (c) comprises applying the cover layer  
2 by electroplating.
- 1 16. The method of any one of claims 9-12, wherein step (c) comprises treating  
2 the roughened implant body surface with a laser so that roughness peaks  
3 produced by step (b) are worn down and notch-like indentations are  
4 reshaped to form rounded lacunae.
- 1 17. The method of any one of claims 9-12, wherein step (c) comprises treating  
2 the roughened implant body surface by a galvanic erosion process so that  
3 roughness peaks produced by step (b) are worn down and sharp-edged  
4 indentations are filled up to form rounded lacunae.

- 1 18. The method according to claim 17, wherein the roughened implant body  
2 surface functions as a cathode in the galvanic erosion process for removal  
3 of the roughness peaks.
- 1 19. The method of claim 15, wherein the cover layer is applied up to a thickness  
2 that corresponds substantially to a surface roughness of a bone cell profile.
- 1 20. The method of claim 19, wherein the cover layer is applied to a thickness  
2 between 0.1 and 2 micrometers.
- 1 21. The method of claim 9, wherein the implant body surface parts to be treated  
2 in step (b) and step (c) are delineated from other surface parts of the implant  
3 body by masking, and the other surface parts are covered while the method  
4 steps (b) and (c) are being carried out.
- 1 22. The method of claim 9, wherein step (a) comprises fabricating an implant  
2 body with a macrostructure to fasten the implant body into bone and  
3 wherein the microstructure formed by steps (b) and (c) is applied to the  
4 macrostructure.
- 1 23. The method of claim 9, further comprising:  
2 (e) forming a nanostructure on the microstructure, the nanostructure  
3 being formed by an array of rounded domes separated by rounded  
4 lacunae wherein a size of the nanostructure domes, a spacing  
5 between the nanostructure domes and a depth of the nanostructure  
6 lacunae are substantially one decimal order of magnitude smaller  
7 than corresponding dimensions of the microstructure.

24. The method of claim 23, wherein the depth of the nanostructure lacunae is in the range of 10-500 nm and the spacing between the nanostructure domes is in the range of 100-500 nm.